J Rehabil Med 2011; 43: 500–505

ORIGINAL REPORT

GUIDED INTERNET-BASED COGNITIVE BEHAVIOURAL TREATMENT FOR CHRONIC BACK PAIN REDUCES PAIN CATASTROPHIZING: A RANDOMIZED CONTROLLED TRIAL

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Objective: **The aim of this study was to investigate whether an Internet-based cognitive behavioural intervention would have an effect on the symptoms of chronic back pain.**

Design: **Experimental design with a treatment group and a control group measured before and after a treatment period.**

Subjects: **Participants who met the criteria for chronic back pain ($n = 54$).**

Methods: **All participants were screened in a live, structured interview before inclusion. The study period was 12 weeks and the treatment consisted of education, cognitive skills acquisition, behavioural rehearsal, generalization and maintenance. The main outcome of interest was the catastrophizing subscale of the Coping Strategies Questionnaire.**

Results: **There were statistically significant reductions from pre- to post-treatment in catastrophizing in the treatment group, and an improvement in quality of life for the treatment group. However, most outcome measures did not indicate a positive treatment outcome. On a scale measuring pain catastrophizing, 58% (15/26) of the treated participants showed reliable improvement, compared with 18% (5/28) of the control group.**

Conclusion: **Internet-based cognitive behavioural therapy can serve as a complement for individuals with chronic pain who prefer this treatment and have difficulties accessing specialist treatment facilities.**

Key words: chronic back pain; Internet-based treatment; pain management programme; minimal therapist contact; cognitive behavioural therapy.

J Rehabil Med 2011; 43: 500–505

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Submitted September 8, 2010; accepted February 21, 2011

INTRODUCTION

Pain is one of the most common causes of disability and sick leave, and while there is evidence to suggest that multidisciplinary therapy approaches incorporating cognitive behavioural therapy (CBT) lead to decreased activity limitations and increased participation (1, 2), access to such treatment approaches is hindered by lack of trained practitioners and high costs (2). One option for a proportion of patients with chronic pain conditions could be to develop and administer largely self-administered treatments, hereafter referred to as guided self-help (3). It has increasingly become clear that unguided self-help programmes lead to lower effect sizes and larger drop-out rates (4), and this is probably also the case in the treatment of chronic pain (5). In the field of pain, most research activities have focused on headache (6), but there are also applications for low back pain and related conditions (7). Since the advent of the Internet, intense research activities have been devoted to the transfer of guided self-help programmes to the Internet. This commonly involves at least some of the treatment decisions being delegated to the computer (8), and the actual treatment programme may consist of book-length texts and Internet-based activities (3). Support is usually provided via e-mail (9), but can also include telephone support to foster adherence to the programme (10). The present study investigates the effects of guided Internet-based CBT (iCBT), when the support is provided by a single therapist over the Internet. A systematic review found some preliminary support for guided iCBT for chronic pain (11), but only 3 controlled studies on chronic pain were included. One study dealt with children (12) and another with adults, including people with burnout syndrome (13, 14), a form of stress-related long-term exhaustion and diminished interest, which is recognized in the International Classification of Diseases-10 (ICD-10). Both studies showed promising results with moderate effect sizes. We completed a study, included in the systematic review (11), in which a CBT programme was tested in a randomized trial showing a reduction of pain-related disability, mainly relating to catastrophizing (15). However, an aspect of that study was that we could not separate the effects of the telephone support provided from the self-help programme. While telephone and online support both bridge distances, a main difference is that e-mails can be answered and support given when the therapist finds it suitable, whereas telephone support must be handled directly. This limits the flexibility, both for the therapist and the patient, as telephone conversations must be booked in advance. A limitation of the previous trial (15) was

that participants were not seen for a live interview. In the trial reported here we interviewed the participants in a structured live interview prior to inclusion, which did not occur in the previous trial. A particular interest in the trial reported here was the drop-out rate, as our previous trial with telephone support had a drop-out rate of only 8% (15).

While there is limited evidence that iCBT is useful for persons with chronic pain, it is not clear if this treatment approach is effective for the same outcome variables as in face-to-face CBT. Since we previously found effects on subscales of the Coping Strategy Questionnaire (CSQ) (16) catastrophizing subscale, we also used this subscale as the main outcome measure in this trial.

The aim of the present study was to test the effects of an iCBT pain management programme with e-mail support only. We hypothesized that this approach would lead to a reduction in pain complaints as measured by the CSQ, in line with our previous study.

METHODS

Recruitment procedure and inclusion

Participants were recruited by means of newspaper articles in national and regional papers, as well as through a webpage on the Internet. The webpage included an outline of the study, and an application form including questions partly derived from the Philips & Rachman's manual (17) and from Ström et al. (18). The Hospital Anxiety and Depression Scale (HADS) (19) was also included to screen for depression and anxiety. We did not exclude participants on the basis of this screening. Those who completed the form were called for a structured interview in Uppsala, unless otherwise indicated (see below). All participants were screened in a live, structured interview prior to inclusion in the study. The structured interview (available on request from the first author) was carried out by two clinical psychologists who later were therapists in the trial. Briefly, the interview covered pain symptoms, other medical and psychological conditions, previous and ongoing treatments, and information about the study. During the interview the participant completed an informed consent form permitting the study coordinator (first author) to contact his or her physician if necessary. The participants were asked to complete the Montgomery Åsberg Depression Rating Scale (MADRS-self rated) (20), which was used only for screening purposes and was not administered at post-treatment. If levels of depression were high (> 20 on the MADRS-S) we did not include the participant. In addition, participants were asked to sign an informed consent form and to contact their physician if required. A total of 80 persons indicated an interest in the study. Sixty fulfilled the inclusion criteria, which included: (*i*) age between 18 and 65 years; (*ii*) access to the Internet; (*iii*) having been in contact with a physician; (*iv*) back pain (i.e. lumbar, thoracic and/or cervical) of chronic nature (i.e. pain longer than 3 months); (*v*) in current employment or on short-term sick leave (not longer than 6 months); (*vi*) not a wheelchair user; (*vii*) no planned surgical treatment; and (*viii*) no history of cardiovascular disease. The last criteria was based on self-report and was motivated by the risk of otherwise including persons who may become in urgent need of healthcare procedures.

Of the 60 eligible participants who met all the inclusion criteria, 54 agreed to participate in the study. Of these 54, 26 were randomly assigned to the treatment condition and 28 to the control condition. Randomization was made by an independent person through a webpage with a randomization program (www.random.org). Participants were informed about inclusion in the trial and the treatment allocation after completion of the interview via e-mail. Hence, randomization was carried out after the interview. Following the live structured interview and informed consent the participants were randomly assigned to the pain management programme or the waiting list. There were no statistically significant differences between the groups after randomization. Participants were instructed to monitor their pain intensity on a daily basis for two weeks before and two weeks after the treatment period (recorded as a pain diary). Compliance with the diary recording was incomplete and data are not presented here due to missing values. All participants were, however, asked to complete the online questionnaire measures at pre- and post-treatment. The treatment was free of charge, but Internet subscription as well as transportation costs to and from the interview at Uppsala was not reimbursed. All treatment was conducted in Swedish. The medical ethics committee approved of the study protocol and informed consent was obtained. The trial was registered after completion in ClinicalTrials.gov (NCT01329861).

Intervention procedure

In order to ensure that the technical requirements were as easily accessible as possible, participants had access to a computer technician via e-mail for instructions and technical support. Participants were encouraged to download and print text material. The treatment and forms were accessible only with a password provided to the participants. All treatment contact with participants was via e-mail. The therapist responded to questions, and provided feedback and encouragement on a weekly basis, in association with the completion of treatment modules and homework assignments. Approximately 10–15 min per week was spent on each participant, giving a total maximum e-mail correspondence time of 7 × 15 min (105 min), as the last treatment module did not contain any homework to submit. However, this estimation is in the upper range, as not all participants completed all modules and the therapists varied in how rapidly they could provide feedback based on previous similar feedback, typing speed, etc. The actual time spent on each participant was not recorded in detail.

The participants in the treatment group were contacted once by telephone by one of two therapists in the trial, but not by their own therapist. The purpose of the telephone call was to give the participants the opportunity to ask questions and to find out how the treatment was proceeding, mainly from a technical point of view. The telephone conversation was structured and was made after two weeks of treatment. During the treatment participants followed a scheduled programme and submitted weekly reports on treatment progress and homework assignments. Reminders were sent to participants when reports on progress were not delivered as expected. The therapists involved were 4 clinical psychologists with experience in behavioural medicine who were trained in CBT.

The intervention was a self-help management programme administered via the Internet. The programme was based on a cognitive behavioural model of chronic pain (21) and was derived from the extensive CBT literature on chronic pain (22). The participants were instructed to test and practice different coping strategies, such as relaxation, cognitive skills, stress management, as well as stretching and physical exercise techniques, on an individualized graded activity basis with structured instructions. The text was divided into 8 modules. Participants were prompted to submit weekly reports on treatment progress (e.g. homework assignments). The weekly components of the programme are summarized in Table I.

Materials

Measures were obtained pre- and post-intervention.

Primary outcome measure

Coping Strategies Questionnaire – catastrophizing subscale. The CSQ is a 50-item questionnaire (16) assessing cognitive and behavioural coping strategies. It covers 8 different coping strategies for pain-diverting attention, re-interpreting pain sensation, coping self-statements, ignoring sensations, praying and hoping, catastrophizing, increased behavioural activities and pain behaviour. The subscale Pain behaviour has low inter-item reliability (23). Jensen & Linton (23) recommended the exclusion of the strategy from the Swedish version. At the end of the questionnaire patients are asked to rate the overall effectiveness of the coping strategies used, by responding to two questions: (*i*) level of control over experienced pain; and (*ii*) ability to decrease perceived pain. The effectiveness of assessments is not very reliable, since it is

Table I. *Overview of the treatment programme (a more detailed description is available on request from the first author)*

Assignments	Information	Webpages
Pre-treatment assessment		
Week 0–1	Information about treatment and randomization	
Pain diaries 1 and 2 (2 weeks)		
Self-report measures		
Treatment phase		
Week 2 (Relaxation)	Information about pain	Information: 4 pages
Diaphragmatic breathing		
Formulation of goals and risk situations		Assignments: 12 pages
Sett compass heading		
Week 3 (Relaxation)		
Bodyscan	Information about physical exercise, stretching, posture and ergonomics	Information: 3 pages
Formulation of exercise plan		Assignments: 19 pages
Stretching and warm-up exercises		
Week 4 (Relaxation)		
Bodyscan 2	Information about pacing, activity planning and cognitive reconstruction	Information: 4 pages
Cognitive reconstruction		Assignments: 17 pages
Activity plan		
Coping diary		
Week 5 (Relaxation)		
Bodyscan 3	Information about stress and stress management	Information: 8 pages
Activity plan related to the participant's goals		Assignments: 19 pages
Thought record		
Coping diary		
Week 6 (Relaxation)		
Mindfulness	Information about sleep disorders	Information: 8 pages
Activity plan related to the participant's goals		Assignments: 8 pages
Coping diary		
Week 7		
Activity plan related to the participant's goals	Information about communication skills and conflict resolution methods	Information: 3 pages
Coping diary		Assignments: 9 pages
Week 8		
Activity plan related to the participant's goals	Information about problem solving	Information: 3 pages
Coping diary		Assignments: 6 pages
Week 9		
Formulation of maintenance programme	Information about maintaining coping strategies	Information: 3 pages
Coping diary	Summary	Assignments: 3 pages
Week 10–11		
Pain diary		
Self-report measures		

based only on the questions mentioned above (23). The Swedish version has a high inter-item reliability, $a = 0.7–0.8$. The test-retest reliabilities are not as satisfactory, $r = 0.4–0.9$ (23). Here we considered the catastrophizing subscale as our primary outcome measure.

Secondary outcome measures

Multidimensional Pain Inventory (MPI). MPI, assess psychosocial and behavioural consequences of pain (24). MPI has been translated into Swedish, MPI-S (25). MPI-S is a 34-item questionnaire divided into 2 sections and consisting of 8 scales. These are: Pain Severity, Interference, Life Control, Affective Distress, Support, Punishing Responses, Solicitous Responses and Distracting Responses. The third part has been excluded in the Swedish version because the scale structure could not be verified. For the first section of MPI-S, the internal consistency is $a = 0.80$, for section 2 $a = 0.76–0.86$, and for section 3 $a = 0.67–0.81$ (25). The test-retest coefficients for the MPI-S are $r = 0.73–0.89$ (25). The discriminate validity for sections 1 and 2, after excluding 4 statements, indicates that the MPI-S has the same scale structure as the MPI (25).

Pain and Impairment Relationship Scale (PAIRS). The PAIRS consists of 15 personal statements that reflect thoughts, attitudes and opinions about pain (26). The questionnaire assesses beliefs and attitudes that patients have regarding pain and ability to function despite discomfort. PAIRS has an internal consistency of $a = 0.82$. Test-retest reliability is $r = 0.66$ (26).

Hospital Anxiety and Depression Scale. HADS, is a questionnaire containing 14 items and is designed to measure anxiety and depression in non-psychiatric patients treated at hospital clinics (19). Items referring to physical symptoms (e.g. dizziness or headaches) have been eliminated, since such reactions may also be attributed to the medical disease and treatment itself. The internal consistency for the anxiety scale is $a = 0.80–0.93$ and for the depression scale $a = 0.81–0.90$. Test-retest reliability after 2 weeks is $r = 0.80$ (27).

Quality of Life Inv'ntory (QOLI). QOLI contains 32 items for assessing life satisfaction (28). The assessment yields an overall score and profile for 16 areas of life: health, self-esteem, goals and values, money, work, play, learning, creativity, helping, love, friends, children, relatives, home, neighbourhood and community. Each item is rated in terms of importance and satisfaction. Test–retest coefficients for QOLI ranged from 0.80 to 0.91 and internal consistency coefficients ranged from 0.77 to 0.89 across 3 clinical and 3 non-clinical samples (28).

Statistical analyses

Data were analysed using the intention-to-treat principle with all available data regardless of completion of the actual treatment. Participants lost to follow-up were first not replaced using last observation carried forward, as this assumes stability from pretreatment. Given the few drop-outs, we regarded this as a defensible procedure instead of modelling the lost observations ($n = 5$) using bootstrap methodology or mixed models approaches. However, all analyses were repeated with the 5 missing cases replaced by their baseline data. This did not affect the outcome. Power was estimated from previous iCBT effect sizes (11). A conservative estimation yielded an expected standardized mean difference of $d = 0.50$ (1). With conventional levels of confidence ($p < 0.05$) a sample size of 64 would be required, which we also aimed for. This was based on the assumption that the catastrophizing subscale of the CSQ could be used as a proxy for the outcome, since it was a sensitive measure of treatment effects in our previous trial (15). Since we did not reach 64 participants the study was underpowered.

We used analysis of variance (ANOVA) and multivariate analysis of variance (MANOVA) to detect interaction effects in the 2×2 design for the continuous measures, and χ^2 for categorical variables. Data from the self-report measures was checked for normality assumptions and found to be suitable for parametric analyses. For the categorical outcomes we calculated Jacobson's reliable change index for each individual based on the pre-treatment score, the post-treatment score and the standard error of the difference (Xpost–Xpre)/S diff (29).

RESULTS

Included participants are described in Table II. Four participants dropped out without providing post-treatment data (7.4%, 4/54), with 3 in the treatment group and 1 in the control group.

Eight participants in the treatment group failed to complete all modules in time, but provided post-treatment data.

Coping Strategies Questionnaire

Means and standard deviations for all outcome measures are presented in Table III. A significant interaction was obtained for the outcome measure *catastrophizing* ($F(1,48=11.9$, $p=0.0001$). There were no significant effects for the other CSQ subscales. A *post hoc* test on the pre- to post- change scores confirmed a difference between the groups at post-test (Bonferroni corrected).

Multidimensional Pain Inventory

MANOVA did not show any significant interactions.

Pain and Impairment Relationship Scale

ANOVA showed no significant interaction between group and time. A significant effect for time was found ($F(1,48)=3.9$, $p=0.05$), that is both groups experienced a reduction in functional impairment, and beliefs and attitudes regarding pain improved regardless of group allocation.

Hospital Anxiety and Depression Scale

ANOVA did not show any significant interaction effects for either HADS-anxiety or HADS-depression. There was a main effect of time for HADS-anxiety ($F(1,48)=4.1$, $p=0.05$), but not for HADS-depression.

Table II. *Participant characteristics*

	Total ($n=54$)	Treatment ($n=26$)	Control ($n=28$)
Ag, years, mean (SD)	43.2 (9.8)	43.5 (9.8)	42.9 (10.1)
Pain duration in years, mean (SD)	12.1 (8.5)	12.1 (7.8)	13.1 (9.2)
Gender,% (*n*)			
Men	31.5 (17)	26.9 (7)	35.7 (10)
Women	68.5 (37)	73.1 (19)	64.3 (18)
Education, % (*n*)			
Nine-year compulsory school	5.6 (3)	3.8 (1)	7.1 (2)
Upper secondary school	40.7 (22)	50.0 (13)	32.1 (9)
University education <2 years	22.2 (12)	23.1 (6)	21.4 (6)
University education >2 years	31.5 (17)	23.1 (6)	39.3 (11)
Sick leave, % (*n*)			
Yes	20.4 (11)	23.1 (6)	17.6 (5)
No	79.3 (43)	76.9 (20)	82.1 (23)
Pain location, % (*n*)			
Back	33.3 (18)	26.9 (7)	39.3 (11)
Back[a]	66.7 (36)	73.1 (19)	60.7 (17)
Treatment history[b], % (*n*)			
Physical therapist	42.6 (23)	38.5 (10)	46.4 (13)
Chiropractor	61.1 (33)	57.7 (15)	64.3 (18)
Naprapath	13.0 (7)	15.4 (4)	10.7 (3)
Psychologist	11.1 (6)	11.65 (3)	10.7 (3)
Pain clinic	1.9 (1)	0.0 (0)	3.6 (1)
Surgical operation	1.9 (1)	0.0 (0)	3.6 (1)
No paramedic treatment	16.7 (9)	19.2 (5)	14.3 (4)

[a]Back pain and pain that is not located on the back (i.e. lumbar, thoracic and/or cervical area).
[b]Participants may have tried several different treatments.

Quality of Life Inventory

Results showed a significant interaction between group and time ($F(1,48)=10.8$, $p=0.0002$), and, as seen in Table III, this was explained by a decrease in the control group and an increase in QOLI scores in the treatment group. A Bonferroni corrected *post hoc* test on the pre- to post- change scores confirmed a difference between the groups at post-test.

Clinically significant improvement

For comparison with our previous trial (15), we calculated the reliable change index. We focus here on the CSQ main outcome

Table III. *Means (standard deviations (SDs)) for the Coping Strategies Questionnaire (CSQ), Multidimensional Pain Inventory (MPI), Pain Impairment Rating Scale (PAIRS), Hospital Anxiety and Depression Scale (HADS) and Quality of Life Inventory (QOLI)*

Measure	Group	Pre-treatment Mean (SD)	Post-treatment Mean (SD)
CSQ			
Diverting attention	Treatment	11.2 (5.9)	11.5 (6.5)
	Control	11.4 (5.7)	10.8 (5.5)
Reinterpret pain sensations	Treatment	5.3 (5.2)	6.2 (4.5)
	Control	5.4 (3.9)	6.1 (5.1)
Coping self-statements	Treatment	21.0 (5.9)	19.1 (7.6)
	Control	18.3 (6.7)	19.4 (7.5)
Ignore pain sensations	Treatment	15.4 (6.0)	17.6 (7.7)
	Control	15.3 (7.0)	14.7 (7.4)
Praying or hoping	Treatment	11.0 (7.4)	10.8 (7.0)
	Control	10.8 (5.9)	9.2 (5.9)
Catastrophizing	Treatment	14.3 (6.1)	9.5 (5.5)
	Control	12.0 (8.2)	11.6 (8.2)
Increase activity level	Treatment	16.0 (6.0)	14.3 (5.4)
	Control	15.6 (4.5)	15.9 (5.7)
Control over pain	Treatment	3.3 (1.3)	3.0 (1.1)
	Control	2.9 (1.4)	2.8 (1.5)
Ability to decrease pain	Treatment	3.1 (0.9)	3.3 (0.8)
	Control	3.0 (1.0)	3.0 (1.2)
MPI			
Pain severity	Treatment	3.5 (2.5)	3.15 (2.2)
	Control	3.2 (2.2)	3.35 (2.6)
Interference	Treatment	3.6 (1.2)	3.2 (1.4)
	Control	3.9 (1.3)	3.5 (1.2)
Life control	Treatment	3.1 (1.1)	3.9 (1.0)
	Control	2.7 (0.9)	3.1 (0.9)
Affective distress	Treatment	2.9 (0.9)	2.8 (0.9)
	Control	3.0 (0.6)	3.1 (0.6)
Support	Treatment	4.0 (1.6)	4.2 (1.3)
	Control	3.9 (1.5)	3.8 (1.6)
Punishing responses	Treatment	1.0 (1.4)	0.7 (1.1)
	Control	1.5 (1.4)	1.2 (1.3)
Solicitous responses	Treatment	2.3 (1.4)	2.3 (1.2)
	Control	2.1 (1.4)	1.9 (1.5)
Distracting responses	Treatment	2.5 (1.7)	2.5 (1.6)
	Control	2.7 (1.7)	2.5 (1.7)
PAIRS	Treatment	53.3 (10.4)	49.1 (11.0)
	Control	48.3 (13.7)	46.1 (18.7)
HADS			
Anxiety	Treatment	7.6 (3.7)	5.8 (3.5)
	Control	7.6 (5.1)	7.0 (6.0)
Depression	Treatment	6.3 (4.2)	4.9 (3.6)
	Control	6.3 (4.5)	6.3(5.2)
QOLI	Treatment	1.2 (1.4)	1.7 (1.4)
	Control	1.8 (1.5)	1.1 (1.6)

variable catastrophizing, for which we found a significant effect and which has adequate reliability (30). For this scale 58% (15/26) of the treated participants showed a reliable improvement, and, in the control group, 18% (5/28). This difference was statistically significant χ^2 (1) = 8.6, p = 0.003).

DISCUSSION

The aim of the present study was to investigate whether an iCBT intervention would have an effect on the symptoms of chronic back pain. The results showed that the treatment had an effect on catastrophizing and quality of life. This is partly in line with our previous study (15), which showed significant reductions in catastrophizing, increased control over pain and ability to decrease pain. The finding of reduced catastrophizing may be caused by the exposure inherent in our CBT programme and the inclusion of cognitive restructuring. However, the knowledge on mechanisms behind treatment effects is not clear (31). The outcome on the quality of life measure in the control group is difficult to understand, as the decrease in the control group was larger than the increase in the treatment group. It may be that the QOLI is less sensitive to treatment effects, or that this particular measure revealed a demoralizing effect of being randomized to the waiting list control group.

There are some important differences between the two studies. This study did not include telephone calls to remind and encourage the participants, but on the other hand all participants went through a live structured interview before inclusion and one telephone call early in the treatment to ensure that the technical parts of the programme were working. Moreover, in contrast to our previous trial, a measure of quality of life was included this time. Since we found rather similar results when it comes to catastrophizing, we conclude that the telephone support is not necessary as long as e-mail support is in place. This is in line with a previous headache study, in which no differences were observed between telephone-guided Internet treatment vs e-mail guided treatment alone (32). The present study and others (13, 14, 33, 34) suggest that an Internet-based treatment can be effective for some individuals with chronic pain. Clinical trials have shown that CBT and multidisciplinary treatments are effective for persisting pain, but that the effects are not strong (1). The treatment programme tested in our study was adapted from a CBT-based multidisciplinary pain management programme, with the difference that the treatment was administered via the Internet. Several Internet-based CBT programmes have been developed and tested for different problems in adults, with effective and promising results (9). Even though the effect sizes for health problems are slightly below those found for Internet-based interventions for anxiety and depression (11), the results are promising. The availability of CBT-trained professionals is limited, the waiting lists for treatment are often long and the costs high, which makes Internet treatment a potential complement or alternative intervention for patients who are able to use computers and have the language and reading skills needed to work with guided self-help. Internet-based interventions could also be delivered within a stepped care model in clinical practice, starting with a low-intensity self-help intervention and moving on if the first approach is not effective (35).

There are limitations to this study. One is the fact that the participants were self-recruited by the means of newspapers and a website and not from a clinic or general practice setting. Internet-based interventions require that the patient has access to a computer with an Internet connection and knows how to use the computer (3). However, Internet access is spreading rapidly, and in Sweden approximately 90% of the population between 16 and 74 years of age has access to the Internet (www.Internetworldstats.com). Furthermore, it should be noticed that the majority of the participants were not on sick leave, which is a difference from clinical treatments where the majority are on sick leave. This was also found in our earlier trial (15), and may implicate that our samples have been less severe and distressed. However, the scores on the instruments used in this study and the previous trial (15) do not differ much from other pain studies (25). As we only included post-treatment data, lack of long-term follow-up data is a limitation, given the limited long-term effects of regular CBT for chronic pain with the possible exception of mood outcomes (36). Since effects of iCBT for chronic pain tend to be weak, we regard the small sample size as a major limitation, and it may even be that we overestimated the expected effect size (d = 0.50) on which we based our power calculations. A final limitation relates to the number of outcome measures included, as most participants did not show any benefit from treatment. This is a problem relating to mass significance, but also to a potential lack of sensitivity of the measures used. However, the effects we found were not weak, although they were limited to a few outcome measures.

In conclusion, this study suggests that iCBT can result in a decrease in catastrophizing and an improvement in quality of life. Results should be replicated by independent researchers and long-term benefits should be investigated. Furthermore, the effects of iCBT in clinical settings should be assessed (37).

ACKNOWLEDGEMENTS

This study was sponsored in part by a grant from the Swedish Council for Working and Life Research. Lars Ström has a private practice in which Internet treatment is provided.

The authors report no conflict of interest.

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